

Executive Summary

The mission of the Ceramics Division is:

Work with industry, standards bodies, academia, and other government agencies in providing the leadership for the Nation's measurements and standards infrastructure for ceramic materials.

The range of ceramic materials on which we work is broad, ranging from oxides and nitrides to materials resembling semiconductors, pertinent to a wide spectrum of important applications. Ceramics in the broadest sense are crucial to many modern technologies including wireless communication, photonics, and biomaterials. Ceramics are used in components, not just as monolithic parts, but as films, coatings, or single crystals. Throughout this range of materials, there are common measurement issues, e.g., phase identification, the role of microstructure on properties, brittle material design, and many others.

We continue to look for improved ways to develop meaningful communication with our customers, i.e. the engineers and scientists in both companies and universities who use the measurement tools that we are developing. In this context, the first NIST Recommended Practice Guide on “*Particle Size Characterization*”, authored by Ajit Jillavenkatesa, Sandy Dapkunas, and Lin Lum, has been completed, and will be published shortly. Practice Guides on “*Design with Brittle Materials*” and “*Nomenclature for Particle Dispersion Technology and Rheological Measurements*” will be published later this year.

Workshops continue to be an important way for us to identify industrial measurement needs. During this past year we held workshops related to measurement needs for Low Temperature Co-fired Ceramics (LTCC) for wireless applications, Tribological Issues for Nanotechnology, and Texture Measurements for Ceramic Microstructures.

During the past year, the Ceramic Manufacturing Program, led by Said Jahanmir, was expanded to include topics related to property measurement and reliability prediction of ceramic materials and components, areas of core expertise in the Division for many years. The reorganization was undertaken to better integrate processing with performance prediction.

Based upon the needs expressed at the LTCC Workshop mentioned above, we have also expanded activities related to materials for wireless communication into the area of low temperature co-fired ceramics. In partnership with the NIST Radio-Frequency Technology Division, several follow-on meetings were held with industrial producers and users of LTCC devices. They strongly expressed a need for processing models for these complex, multilayer, devices. This need has led to the initiation of new work within the Division.

Progress was made in our efforts to link the databases in Phase Diagrams and Inorganic Crystal Structures, which we manage with the x-ray diffraction database held by the International Centre for Diffraction Data (ICDD). A Memorandum of Understanding has been agreed to by NIST, the American Ceramic Society, and ICDD. A feasibility study to determine the technical issues involved in this linkage will be initiated shortly.

Our Collaborative Access Team synchrotron beamline at the Advanced Photon Source (APS) in Argonne, Illinois, which we share with the University of Illinois, Oak Ridge National Laboratory, and UOP Corp. was formally dedicated, and is now operational. The APS is the premier synchrotron radiation source in the world, and will provide a unique venue for the development of the next generation of measurements for materials with increasingly smaller features. Our small angle x-ray scattering instrumentation which we developed as part of this partnership is the most frequently used portion of the beamline to date.

Finally, I am extremely pleased that a number of our Division staff have been honored this year. Ed Fuller and Andy Roosen (along with Steve Langer in ITL) received the Jacob Rabinow Applied Research Award for their development of an Object Oriented Finite Element (OOF) analysis; these same individuals, along with Craig Carter at MIT also received a Technology of the Year Award from “Industry Week” for their work on OOF. George Quinn was the recipient of a NIST Bronze Medal. Gabrielle Long received the Maria Goeppert-Mayer distinguished Scholar Award from Argonne National Laboratory. Steve Hsu was made a Fellow of the Society of Tribological and Lubrication Engineers. Winnie Wong-Ng was made a Fellow of ICDD. Doug Blackburn, a retired Division employee, was presented the Sigma Xi Award for outstanding service in support of research scientists. Howard McMurdie, a retired staff member, was given the Barrett Award by the Denver X-ray Conference.

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